§ 73.316 FM antenna systems.

(a) It shall be standard to employ horizontal polarization; however, circular or elliptical polarization may be employed if desired. Clockwise or counterclockwise rotation may be used. The supplemental vertically polarized effective radiated power required for circular or elliptical polarization shall in no event exceed the effective radiated power authorized.

(b) *Directional antennas.* A directional antenna is an antenna that is designed or altered for the purpose of obtaining a non-circular radiation pattern.

(1) Applications for the use of directional antennas that propose a ratio of maximum to minimum radiation in the horizontal plane of more than 15 dB will not be accepted.

(2) Directional antennas used to protect short-spaced stations pursuant to § 73.213 or § 73.215 of the rules, that have a radiation pattern which varies more than 2 dB per 10 degrees of azimuth will not be authorized.

(c) *Applications for directional antennas.* Applications proposing the use of directional antenna systems must be accompanied by the following:

(1) A complete description of the proposed antenna system, including the manufacturer and model number of the proposed directional antenna. It is not sufficient to label the antenna with only a generic term such as ''dipole''. A specific model number must be provided. In the case of individually designed antennas with no model number, or in the case of a composite antenna composed of two or more individual antennas, the antenna must be described as a ''custom'' or ''composite'' antenna, as appropriate. A full description of the design of the antenna must also be submitted.

(2) A relative field horizontal plane pattern of the proposed directional antenna. A single pattern encompassing both the horizontal and vertical polarization is required, rather than separate patterns for horizontal and vertical polarization. A value of 1.0 must be used to correspond to the direction of maximum radiation. The plot of the pattern must be oriented such that 0° corresponds to the direction of maximum radiation or alternatively, in the case of an asymmetrical antenna pattern, the plot must be oriented such that 0° corresponds to the actual azimuth with respect to true North. The horizontal plane pattern must be plotted to the largest scale possible on unglazed letter-size polar coordinate paper (main engraving approximately 18 cm x 25 cm (7 inches x 10 inches)) using only scale divisions and subdivisions of 1, 2, 2.5, or 5 times 10-nth. Values of field strength less than 10% of the maximum field strength plotted on that pattern must be shown on an enlarged scale. In the case of a composite antenna composed of two or more individual antennas, the pattern required is that for the composite antenna, not the patterns for each of the individual antennas.

(3) A tabulation of the relative field pattern required in paragraph (c)(2) of this section. The tabulation must use the same zero degree reference as the plotted pattern, and must contain values for at least every 10°. In addition, tabulated values of all maximas and minimas, with their corresponding azimuths, must be submitted.

(4) Sufficient vertical patterns to indicate clearly the radiation characteristics of the antenna above and below the horizontal plane. Complete information and patterns must be provided for angles of ±10° from the horizontal plane and sufficient additional information must be included on that portion of the pattern lying between +10° and the zenith and −10° and the nadir, to conclusively demonstrate the absence of undesirable lobes in these areas. The vertical plane pattern must be plotted on rectangular coordinate paper with reference to the horizontal plane. In the case of a composite antenna composed of two or more individual antennas, the pattern required is that for the composite antenna, not the patterns for each of the individual antennas.

(5) A statement that the antenna will be mounted on the top of an antenna tower recommended by the antenna manufacturer, or will be side-mounted on a particular type of antenna tower in accordance with specific instructions provided by the antenna manufacturer.

(6) A statement that the directional antennas will not be mounted on the

top of an antenna tower which includes a top-mounted platform larger than the nominal cross-sectional area of the tower in the horizontal plane.

(7) A statement that no other antennas of any type are mounted on the same tower level as a directional antenna, and that no antenna of any type is mounted within any horizontal or vertical distance specified by the antenna manufacturer as being necessary for proper directional operation.

(8) In the case of applications for license upon completion of antenna construction, a statement from an engineer (as well as a statement of the engineer's qualifications) that the antenna has been installed pursuant to the manufacturer's instructions and a statement from a licensed surveyor that the antenna is installed in the proper orientation.

(9) In the case of an application for license upon completion of antenna construction for a station authorized pursuant to §73.215 or §73.509, a showing that the root mean square (RMS) of the measured composite antenna pattern (encompassing both the horizontally and vertically polarized radiation components (in relative field)) is at least 85 percent of the RMS of the authorized composite directional antenna pattern (in relative field). The RMS values, for a composite antenna pattern specified in relative field values, may be determined from the following formula:

RMS = the square root of:

$$\frac{[(\text{relative field value 1})^2 + (\text{relative field value 2})^2 + \cdots + (\text{last relative field value})^2]}{\text{number of relative field values summed}}$$

where the relative field values are taken from at least 36 evenly spaced radials for the entire 360 degrees of azimuth. The application for license must also demonstrate that coverage of the community of license by the 70 dBu contour is maintained for stations authorized pursuant to §73.215 on Channels 221 through 300, as required by §73.315(a), while noncommercial educational stations operating on Channels 201 through 220 must show that the 60 dBu contour covers at least a portion of the community of license.

(d) Applications proposing the use of FM transmitting antennas in the immediate vicinity (*i.e.* 60 meters or less) of other FM or TV broadcast antennas must include a showing as to the expected effect, if any, of such approximate operation.

(e) Where an FM licensee or permittee proposes to mount its antenna on an AM antenna tower, or locate within 3.2 km of an AM antenna tower, the FM licensee or permittee must comply with §73.1692.

(f) When an FM broadcast antenna is mounted on a nondirectional AM broadcast antenna, new resistance measurements must be made of the AM broadcast antenna after installation and testing of the FM broadcast antenna. During the installation and until the new resistance determination is approved, the AM broadcast station licensee should operate by the indirect method of power determination. The FM broadcast license application will not be considered until the application form concerning resistance measurements is filed for the AM broadcast station.

(g) When an FM broadcast antenna is mounted on an element of a AM broadcast directional antenna, a full engineering study concerning the effect of the FM broadcast antenna on the directional pattern must be filed with the application concerning the AM broadcast station. Depending upon the individual case, the Commission may require readjustment and certain field strength measurements of the AM broadcast station following the completion of the FM broadcast antenna system.

(h) When the proposed FM antenna is to be mounted on a tower in the vicinity of an AM station directional antenna system and it appears that the operation of the directional antenna system may be affected, an engineering study must be filed with the FM application concerning the effect of the FM antenna on the AM directional radiation pattern. Field strength measurements of the AM station may be required prior to and following construction of the FM station antenna, and readjustments made as necessary.

(i) Information regarding data required in connection with AM broadcast directional antenna systems may be found in §73.150 of this chapter. (See

also AM Broadcast Technical Standards.)

[28 FR 13623, Dec. 14, 1963, as amended at 34 FR 14222, Sept. 10, 1969; 37 FR 25841, Dec. 5, 1972; 43 FR 53738, Nov. 17, 1978; 48 FR 29508, June 27, 1983; 51 FR 17028, May 8, 1986; 54 FR 9804, Mar. 8, 1989; 56 FR 57294, Nov. 8, 1991; 58 FR 44950, Aug. 25, 1993; 62 FR 51058, Sept. 30, 1997]

EFFECTIVE DATE NOTE: At 62 FR 51058, Sept. 30, 1997, § 73.316 was amended by adding paragraph (c)(9); by revising paragraph (e); and by removing paragraphs (f) through (i), effective Dec. 1, 1997. For the convenience of the user, the superseded text is set forth as follows:

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* * * * *

(e) In cases where it is proposed to use a tower of a AM broadcast station as a supporting structure for an FM broadcast antenna, an application for construction permit (or modification of construction permit) for such AM broadcast station must be filed for consideration with the FM application, only in the event the overall height of the AM broadcast station tower changes. Applications may be required for other classes of stations when their towers are to be used in connection with FM stations.

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§ 73.317 FM transmission system requirements.

(a) FM broadcast stations employing transmitters authorized after January 1, 1960, must maintain the bandwidth occupied by their emissions in accordance with the specification detailed below. FM broadcast stations employing transmitters installed or type accepted before January 1, 1960, must achieve the highest degree of compliance with these specifications practicable with their existing equipment. In either case, should harmful interference to other authorized stations occur, the licensee shall correct the problem promptly or cease operation.

(b) Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with this requirement will be deemed to show the occupied bandwidth to be 240 kHz or less.

(c) Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the unmodulated carrier.

(d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least $43 + 10 \log_{10}$ (Power, in watts) dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

(e) Preemphasis shall not be greater than the impedance-frequency characteristics of a series inductance resistance network having a time constant of 75 microseconds. (See upper curve of Figure 2 of § 73.333.)

[51 FR 17028, May 8, 1986]

§ 73.318 FM blanketing interference.

Areas adjacent to the transmitting antenna that receive a signal with a strength of 115 dBu (562 mV/m) or greater will be assumed to be blanketed. In determining the blanketed area, the 115 dBu contour is determined by calculating the inverse distance field using the effective radiated power of the maximum radiated lobe of the antenna without considering its vertical radiation pattern or height. For directional antennas, the effective radiated power in the pertinent bearing shall be used.

(a) The distance to the 115 dBu contour is determined using the following equation:

$D \text{ (in kilometers)} = 0.394 \sqrt{P}$
$D \text{ (in miles)} = 0.245 \sqrt{P}$

Where P is the maximum effective radiated power (ERP), measured in kilowatts, of the maximum radiated lobe.

(b) After January 1, 1985, permittees or licensees who either (1) commence program tests, or (2) replace their antennas, or (3) request facilities modifications and are issued a new construction permit must satisfy all complaints of blanketing interference which are received by the station during a one year period. The period begins with the commencement of program tests, or commencement of programming utilizing the new antenna. Resolution of complaints shall be at no